

SHORT COMMUNICATIONS

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VERTEBRATE PREY IN THE DIET OF FLAMMULATED OWLS IN NORTHERN UTAH

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Flammulated Owls (*Otus flammeolus*) are small, migratory owls which breed in montane forests of western North America (McCallum 1994). They are predominantly insectivorous and prey mainly on lepidopterans and coleopterans (Goggans 1986, Oleyar 2000, Reynolds and Linkhart 1987). However, Holt et al. (1987) reported two cases of Flammulated Owls taking or pursuing vertebrate prey in Montana. The first was of an owl with a vole (*Microtus* sp.) in its talons, and the second was of an owl pursuing songbirds at a feeder. McCallum (1994) found these reports suspect, questioned the accuracy of owl identification, and provided several alternative explanations. In Colorado, Linkhart and Reynolds (1994) found a *Peromyscus* sp. carcass in the nest of a Flammulated Owl and also offered alternative explanations for the carcass other than it being killed by the owl. One alternative was that a different species of owl delivered the food in response to begging calls. Holt (1996) provided examples of vertebrates in the diet of these owls (including stomach contents and nest remains) dating back to 1891. McCallum (1996) was reluctant to assign more ecological flexibility to the species than warranted because it was receiving much attention by land management agencies as a sensitive species (Verner 1994) with a possible preference for older forests (Reynolds and Linkhart 1992). He stressed that no one had actually witnessed a Flammulated Owl kill vertebrates, which leaves open the possibility that these events were owls scavenging rather than killing vertebrates.

We found 13 occurrences of vertebrate prey at 10 different Flammulated Owl nests while studying two populations in northern Utah since 1992 (Marti 1997, Oleyar 2000). In all but one case, remains were in occupied Flammulated Owl nests with 10–18-d-old nestlings. Other small owl species occurring in the area were Northern Saw-whet Owls (*Aegolius acadicus*) and Northern Pygmy-Owls (*Glaucidium gnoma* = *californicum*, currently under review). Saw-whet Owls also used nest boxes, but they and Flammulated Owls never used the same nest box in a single year. Additionally, no other species of owl was observed at any occupied Flammulated Owl nest. We rarely found cached food, and this was only in nest boxes currently occupied by Saw-whet Owls.

The Snow Basin study site is located directly east of Ogden, Weber County, UT, U.S.A. in the Wasatch-Cache National Forest. The Mantua study site is located 32 km north of Snow Basin and just south of Mantua, Box Elder County, UT. Elevations ranged from 1920–1980 m, and both study areas were in forests dominated by quaking aspen (*Populus tremuloides*) and big-toothed maple (*Acer grandidentatum*), with a few clusters of mixed conifers: Douglas-fir (*Pseudotsuga menziesii*), white fir (*Abies concolor*), and subalpine fir (*Abies lasiocarpa*). We checked nest boxes in late April or early May prior to Flammulated Owl arrival on the study area or selection of nest sites. Nest boxes facilitated documenting for prey remains, and we checked each box regularly during the breeding season. Occupied nests were monitored 1–2 times weekly until young fledged.

On several occasions we found remains of vertebrate prey at occupied or recently-occupied active Flammulated Owl nests. In 1994, two immature *Peromyscus* carcasses were in a nest box at Snow Basin, where the young fledged approximately one week previously. In 1997, two pairs of bat (*Vespertilionidae*) wings were found at a Flammulated Owl nest at Mantua. We inspected the box

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earlier in the season, and these remains were not present at that time. Moreover, we found no other skeletal parts in the nest, suggesting to us that the remains were not simply bats that had died in the box. This would represent the first record of Flammulated Owls taking bats as prey. During this same year, we also discovered a wing and a leg of songbirds (Passeriformes) in separate Snow Basin Flammulated Owl nests. In 1998, we found the leg of an unidentified songbird in a nest at Mantua. A *Peromyscus* sp. carcass and the wing of an unidentified songbird were found in Snow Basin nests in 1999. On 15 July 2000 while visiting a nest to weigh and band young, one of the young was swallowing a *Peromyscus* sp. Initially, the hind feet and tail were hanging out of the owl's mouth, but the owl swallowed the mouse in entirety during the visit. During an earlier visit to the same nest, the female and young were observed in the box with the headless carcass of a medium-sized juvenile songbird, possibly an immature Western Tanager (*Piranga ludoviciana*). In 2001, we found another bat carcass in a Snow Basin nest where nestling Flammulated Owls were present. The skin of the bat had recently been ruptured below the rib cage. In a subsequent visit to the nest after young had fledged, most of the carcass was gone and apparently had been eaten. Based upon morphology of the remains and known distribution of bats in the area, the carcass was likely one of three large-footed *Myotis* species: western long-eared bat (*Myotis evotis*), little brown bat (*M. lucifugus*), or long-legged bat (*M. volans*).

In addition to prey remains found in nests, a study of Flammulated Owl feeding rates using a video camera mounted inside the nest in 1998 documented a male Flammulated Owl (female was brooding in box at time) delivering a rodent, probably *Peromyscus* sp. to the nest. The tape shows the female moving the carcass around after delivery, but batteries running the recorder expired before it could be determined if she fed the mouse to her young or ate it herself. No carcass was found in subsequent nest visits, so it is likely she did one of the two. In all, 93.3 hr of videotaping over two breeding seasons (1997 and 1998) yielded 1875 prey deliveries, of which only this one (0.053%) consisted of vertebrate prey (Oleyar 2000).

Our findings suggest that Flammulated Owls on occasion take vertebrate prey. We understand McCallum's (1996) concerns that no observations exist of vertebrates actually being killed by Flammulated Owls. After all, one of the enduring characteristics of science is its demand for evidence. Considering the dearth of knowledge on Flammulated Owl ecology, and that the species was receiving attention as a sensitive species in several Forest Service regions (Verner 1994), McCallum's reluctance to attribute a broader ecological niche to the species is also reasonable. However, remains we found in nest boxes included a variety of vertebrate taxa (birds, bats, and rodents), suggesting that Flammulated Owls will take a variety of prey types. When viewed along with previous

reports of the species taking vertebrate prey (see Holt 1996), there is no question that Flammulated Owls do on occasion consume vertebrate prey. Whether these events represent scavenging or killing of prey remains undetermined. Because most of the time, (>99.99% in our Utah studies), this owl takes invertebrate prey, there is little doubt that it is highly adapted for an insectivorous lifestyle and its ecological role as a predator centers on its insectivorous feeding behavior.

RESUMEN.—Mientras estudiamos la ecología reproductiva de *Otus flammeolus* en el norte de Utah entre 1994–2001, se encontró la presencia de 13 vertebrados presa. Restos de aves, roedores y murciélagos fueron encontrados en nidos ocupados por el búho, adicionalmente se captó, con una cámara de video, la entrega de un mamífero pequeño en el nido. Los vertebrados han sido raramente reportados como presas de estos búhos, los cuales abarcaron 0.01% de la dieta del búho.

[Traducción de César Márquez]

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NESTING HABITAT OF COOPER'S HAWKS IN NORTHERN GREAT PLAINS WOODLANDS

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KEY WORDS: *Cooper's Hawk*; *Accipiter cooperii*; *Great Plains*; *North Dakota*; *nesting habitat*.

Cooper's Hawk (*Accipiter cooperii*) nesting habitat has been described quantitatively in the eastern (Titus and Mosher 1981, Bosakowski et al. 1992), midwestern (Wiggers and Kritz 1991, Garner 1999, Trexel et al. 1999), southwestern (Fischer 1986, Kennedy 1988, Boal and Mannan 1998), and western (Reynolds et al. 1982, Moore and Henny 1983, Asay 1987) regions of North America, but not for the northern Great Plains, where the hawk has been considered a species of special concern due mainly to its perceived scarcity (Nenneman et al. 2002). Woodland habitat within the northern Great Plains was scarce prior to European settlement in the early 1900s, limited primarily to gallery forests along major rivers (Coues 1897, Stewart 1975). Since then, tree coverage has increased. For example, woodland area in northwestern and north-central North Dakota more than doubled during 1938–91 (T. Grant and R. Murphy unpubl. data). Cooper's Hawk nesting habitat in the region may differ from that in other regions due to isolation of avail-

able woodland habitats, lower tree species diversity, and differences in structural complexity of woodlands. Recent studies have shown Cooper's Hawks to be markedly plastic in their nesting habits (Boal and Mannan 1998, Bielefeldt et al. 1998, Trexel et al. 1999). However, species-habitat relationships inferred from data collected in one region may not adequately predict Cooper's Hawk use of woodland habitat in another region (Kennedy 1988, Trexel et al. 1999).

Our objectives were to: (1) describe quantitatively habitat characteristics of Cooper's Hawk nest-sites across the Souris River basin of North Dakota, (2) compare nest site habitat used to woodland habitat available, and (3) compare Cooper's Hawk nesting habitat in North Dakota to that in other regions.

STUDY AREA AND METHODS

Our study area was the Souris River basin in north-central North Dakota (48°40'N, 101°25'W; Ward, Renville, and McHenry counties; Fig. 1). The area is characterized by level to rolling plains found within the Drift Plain physiographic region (Bluemle 1991). Climate is subhumid continental, with mean monthly temperatures ranging from –15°C in January to 20°C in July. Mean annual precipitation is about 42 cm, most of which falls as rain between April and September (U.S. Fish Wildl. Serv. unpubl. data).

The Souris River flows along a 110-km "loop" from Canada south into north-central North Dakota, then back north again (Bluemle 1991; Fig. 1). In 1994–95, we

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